U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Response and Restoration
Coastal Protection and Restoration Division
c/o EPA Region X (ECL-117)
1200 Sixth Avenue
Seattle, Washington 98101

Septemer 23, 2008

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Dear Chip and Eric:

This letter provides **NOAA's comments on EPA's proposed fish TRVs for copper and cadmium.** The NOAA team involved in developing this response to EPA includes Nancy Beckvar and Rob Neely of the NOAA Office of Response and Restoration, James Meador of the NOAA Northwest Fisheries Science Center, and Bob Dexter of Ridolfi, Inc. NOAA appreciates EPA's efforts in developing TRVs for fish and invertebrate tissue at the site. We recognize that this is a challenging and complex endeavor. Because of the challenging schedule, please also recognize that our comments on these and other compounds represent our best effort under the circumstances, which have generally limited our ability to conduct thorough reviews.

NOAA Comments on Proposed Fish TRV for Copper

NOAA believes that the exclusion of the 2002 paper by Handy is not justified. Based on the experimental results, the whole-body copper concentrations in day 0 fish (controls) increased from 0.92 μg/g ww to 2.2 μg/g ww when exposed to copper and they exhibited a mortality of 40%. Because an ACR was used, the whole-body concentration was reduced to a level that was below that measured in control fish. Previous work has shown that the dose-response curve for Cu is steep and the ACR is generally very low. Based on the other studies it is obvious that salmonids are very sensitive to copper as a function of tissue concentration. This artificial adjustment of the critical tissue concentration is not a justification for excluding these results. In this case it would be acceptable to use the measured value of 2.2 μg/g as the critical body residue for this TRV analysis because of the low and undefined lethal to sublethal adjustment factor. This value will likely not change the results. NOAA, however, would like to know if this procedure was used for any of the other studies that were considered for this (or any other) TRV.

We reiterate our concern regarding what we view as the inappropriate application of the ACR. Mortality data that result from long-term exposure are not an appropriate toxicity metric for protecting species from adverse effects.

NOAA is opposed to calculating the geometric mean for a group of notably disparate CBR values. A case in point is the final growth LOER for rainbow trout (RBT). These growth values vary by 41 fold, which is extreme. Four of the five data points are very close and one (18.1 μg/g) appears to be an outlier. This high value should be eliminated based on the weight of evidence showing that RBT exhibit a growth response that is approximately 1.3 μg/g (n=4, Marr et al. (1996) excluded). Because of the low variance for those 4 points, the outlier value is likely due to an error in analytical, experimental, or statistical analyses. Please use one of the many outlier detection tests (e.g., Gibbs, Grubbs, or Dixon) to determine if this value 18.1 μg/g is an outlier. (We used the Grubbs test, which indicated that this value is a statistically significant outlier.)

NOAA Comments on Proposed Fish TRV for Cadmium

The four lowest species LOER data that were included in the final SSD included data for gudgeon, rainbow trout, bull trout, and silver catfish. The discussion accompanying the workbook only discussed the papers supporting the bull trout data, because the other previously-lowest LOER species were eliminated. The data supporting the retained "final four" should all also be discussed. Also, please note that we did not have sufficient time to complete a full analysis, but that we feel that the rainbow trout data should be used in a separate analysis to obtain a TRV protective of salmon.

***Salmo salar* (Atlantic Salmon)**

Peterson et al. (1983)—This study reported significant effects for both growth and mortality (see Table 1 in paper). Table 1 in the excel spreadsheet reports the growth endpoint from this paper and then takes the geometric mean of this growth endpoint and another Rombough and Garside (1982). In the Peterson et al. (1983) study, about 80-94% of fish exposed to 2.0 died after feeding commenced. Using the growth endpoint from this paper is inappropriate given the severity of the lethal endpoint in the treatment where growth was also affected. Therefore, the TRV from this paper should represent a mortality endpoint. Averaging this TRV with the Rombough and Garside (1982) Atlantic salmon growth endpoint, a study where the lower exposure concentrations that caused only sublethal effects is inappropriate.

Please check on the following data point: The TRV value of 37.5 listed for thick lipped mullet refers to an amphipod paper in ERED:

Ahsanullah, M. and A. R. Williams (1991). "Sublethal effects and bioaccumulation of cadmium, chromium, copper and zinc in the marine amphipod Allorchestes-compressa." Marine Biology **108**(1): 59-65.

The marine amphipod Allorchestes compressa Dana, fed on the seagrass Heterozostera tasmanica, was exposed to sublethal concentrations of Cd, Cr, Cu and Zn for 4 wk in flowing sea water, and the concentrations producing the minimum detectable decreases (the minimum effect concentrations, MECs) in average weight, survival and biomass (average weight x survival proportion) were estimated by interpolation from regression models. Survival and biomass were more sensitive than average weight as indicators of sublethal effects. The lowest values of MEC for Cd, Cr, Cu and Zn were 11, > 250, 3.7 and 99-mu-g l-1, respectively. For Cu, this value fell below the minimum risk concentration (MRC) calculated from acute toxicity tests (LC50) and application factors (AF); for Cd, the MEC was similar to the MRC; for Cr and Zn, the MECs were well above the MRCs. The metal concentrations in the amphipods at the MECs were 46, > 46, 364 and 139-mu-g g-1 dry wt for Cd, Cr, Cu and Zn, respectively. Accumulation of the nutrient metals (Cr, Cu and Zn) showed some evidence of metabolic regulation, but the non-nutrient Cd was accumulated without regulation until the amphipods died. In general, those metals that were more highly accumulated by the amphipods were the more toxic.

Some values listed in column F are not carried over into column J in Table 1 in the excel spreadsheet. For example, both von Westerhagen et al. 1974 behavior endpoint for herring of 18.9, and Brown trout mortality of 1.33 are not carried over into the final species LOER column J in Table 1.

Reproductive TRV of 21 ppm from Westerhagen and Dethlefsen 1995 seems high but the paper was not available on ftp site for review.

We are uncertain of how these data will affect the curve, but the following source is in your dataset:

Kumada, H., S. Kimura, M. Yokote, and Y. Matida (1972). "Acute and chronic toxicity, uptake and retention of cadmium in freshwater organisms." Bull. Freshwater. Fish. Res. Lab. **22**(2): 157-165.

NOAA appreciates the opportunity to provide these comments. Please let us know if you have any questions or require further clarification on any of the information we have provided via this comment letter.

Sincerely,

Robert Neely
NOAA Regional Resources Coordinator

cc: Mary Baker, NOAA / NOS / ARD (by email)
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References

Ahsanullah, M. and A. R. Williams (1991). "Sublethal effects and bioaccumulation of cadmium, chromium, copper and zinc in the marine amphipod Allorchestes-compressa." Marine Biology **108**(1): 59-65.

Kumada, H., S. Kimura, M. Yokote, and Y. Matida (1972). "Acute and chronic toxicity, uptake and retention of cadmium in freshwater organisms." Bull. Freshwater. Fish. Res. Lab. **22**(2): 157-165.